NASA Procedural Requirements

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COMPLIANCE IS MANDATORY

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Subject: Safety and Mission Assurance (SMA) Requirements for Experimental Aerospace Vehicles (EAV) w/ Change 1 (3/30/04)

Responsible Office: Office of Safety and Mission Assurance

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CHAPTER 1. Overview

1.1 Introduction

1.1.1 Current and future NASA technology development programs/projects include the design, development, and flight of EAV's.

1.1.2 Regardless of contract form or procurement type, complex and demanding aerospace programs/projects require the implementation of a minimum set of processes to assure safety, manage and minimize risk, and maximize the likelihood of mission success.

1.1.3 The EAV safety program shall address requirements of the ground environment as well as flight environment (Requirement 21001).

1.1.4 Reserved

1.1.5 This NPR describes the SMA program/project process requirements, roles, and responsibilities for EAV operations.

It also describes the process to be used by NASA SMA officials to assure compliance with SMA requirements. The Associate Administrator for Safety and Mission Assurance uses the SMA management process defined in this NPR to obtain the knowledge and information needed to support the providing of SMA Flight Assessment as a part of the flight readiness review process.

1.2 SMA Requirements for EAV Flights

1.2.1 A summary of nominal SMA elements is contained in paragraph 5.3 and Table 2. The program/project manager is responsible for ensuring that all of the elements in Table 2 have been addressed in a timely manner (Requirement 21003). The EAV certifying or performing Center SMA Director(s) is responsible for ensuring that the necessary SMA expertise is available to accomplish the SMA elements listed in Table 2 and that appropriate insight, oversight, and independent assessment is done to assure paragraph 5.3 is satisfied (Requirement 30914).

1.2.2 The Associate Administrator for Safety and Mission Assurance shall provide for each flight or set of flights, through signature of the SMA Flight Assessment (see Chapter 5), that the activities in paragraph 5.1, determined to be appropriate, have been successfully completed and that all identified mission safety risks have been demonstrated by the program/project to be controlled to an acceptable level for flight (Requirement 21005).

1.2.3 The program/project manager (in concert with the range safety officials) shall limit the collective risks associated with EAV operation (see Chapter 6 of NPR 8715.3, NASA Safety Manual) and ensure that the probability of doing harm to the public, astronauts and pilots, workforce, and high-value equipment and property meets the Federal and local range safety requirements (or applicable requirements if no local range authority exists) (Requirement 21006).

1.2.4 The EAV program/project must meet all local test range safety requirements (Requirement 21007). For EAV-managed mission phases, NASA EAV's shall meet the requirement for E_C risk assessment below $30x10^{-6}$ (see Appendix B, paragraph B.1) (Requirement 30915).

1.2.5 If human rating is a requirement of the EAV, and there are conflicts between NPR 8705.2, Human Rating Requirements for Space Flight Systems, and the processes called out in this document then NPR 8705.2 shall take precedence (Requirement 21008).

1.2.6 Launch safety, flight safety, and postflight processing safety shall be addressed as a part of the SMA Preflight Assessment Review (PAR) (Requirement 21009).

1.2.7 The reliability goal of the deorbit burn system to achieve controlled entry to the targeted landing site or debris footprint shall be at least 0.99 (Requirement 21010). The intent is to provide reasonable assurance that the vehicle will be deorbited in a predictable manner (see Appendix B, paragraph B.3).

1.2.8 The EAV program/project shall preplan for orbital, suborbital, and entry flight by developing detailed flight rules, procedures, and checklists prior to Flight Readiness Review (FRR) (or equivalent), for both nominal and contingency operations (Requirement 21011). The EAV program/project shall document scenarios that allow for continued safe flight and landing or flight termination in

a manner that minimizes risk in off-nominal situations. (Requirement 30916).

1.2.9 An entry operation shall not be initiated until conditions critical to safety have been confirmed (Requirement 21012). (This could be verified through review of procedures/flight rules.) Commit to deorbit shall be initiated (enabled) via EAV operator control (Requirement 30917).

1.2.10 Reserved

1.2.11 Appendix B provides a summary of range safety requirements from the Department of Defense (DoD) and the U.S. Federal Aviation Administration (FAA). Due to the fact that most EAV operations will require the use of non-NASA ranges, they are provided in the NPR to assist the program/project manager in understanding some of the fundamental range safety requirements that must be addressed for EAV operations.

1.2.12 For EAV flights which are performed outside of established U.S. ranges, any ranges involved in the EAV flight shall be included in the process in this NPR (Requirement 21069).

1.3 Third-Party Indemnification

A NASA EAV developer (contractor or industry partner) may request indemnification from the NASA Administrator for liability to third parties arising from the operation of an EAV, as EAV is defined in 42 U.S.C. 2458c(d)(3). Among other prerequisites to any grant of indemnification, the developer must "[establish] to the satisfaction of the Administrator that appropriate safety procedures and practices are being followed in the development of the (EAV)" (Requirement 21013). The signature of the Associate Administrator for Safety and Mission Assurance on the SMA Flight Assessment indicates the Associate Administrator's assessment that the developer has satisfactorily established that it is following appropriate safety procedures and practices.

1.4 SMA Management Process

1.4.1 The SMA management process is designed to identify and mitigate EAV risk to acceptable levels. The objectives of the SMA management process are to:

a. Verify that the Enterprise Associate Administrator has defined and established specific safety, mission assurance, and risk management requirements for NASA EAV's. As part of the requirements definition process, the Associate Administrator for Safety and Mission Assurance (or SMA organization leading the SMA Flight Assessment) will conduct a SMA Process Readiness Review (PRR) (see Chapter 2).

b. Verify ongoing implementation of SMA process requirements throughout the design, development, manufacturing, testing, and operation of EAV's. The Center SMA Director has primary responsibility, with support from NASA Headquarters, Center functional organizations, and program/project personnel, to implement EAV SMA processes. The verification step includes development of the Mission Assurance Surveillance Plan (see Chapter 3). The Mission Assurance Surveillance Record (see paragraph 3.3) provides the objective evidence to support SMA decisionmaking for EAV missions. The SMA organization(s) is responsible for the Mission Assurance Surveillance Plan and the Mission Assurance Surveillance Record.

c. Verify that all the SMA activities, determined to be appropriate, have been successfully completed. Verify that all of the identified SMA risks have been controlled to an acceptable level. These will be required as a part of the flight assessment process in the SMA PAR (see Chapter 4).

1.4.2 The SMA flight assessments, recommendations, and certifications on knowledge and understanding will be obtained through objective evidence of policies, processes, tests, analyses, examination of process documentation, objective evidence of process implementation, confidence in reliability and analysis, and participation in the flight/operational readines review process (see paragraph 5.1).

1.4.3 The Associate Administrator for Safety and Mission Assurance (or designated SMA official) will provide:

a. Assessment of the EAV mission assurance process.

b. Signature on flight or operational readiness documents (e.g., Certificate of Flight Readiness [CoFR]).

1.4.4 The Associate Administrator for Safety and Mission Assurance may designate, in writing, a NASA management official to represent the NASA Headquarters Office of Safety and Mission Assurance (OSMA) at EAV reviews. The designee is responsible for keeping the Associate Administrator for Safety and Mission Assurance apprised of all SMA issues and actions (Requirement 21020). The designee may or may not be delegated the responsibility to sign off on the SMA Flight Assessment.

1.5 Roles and Responsibilities

Table 1 delineates the roles and responsibilities of key organizations in the SMA management process for EAV's. It is the responsibility of the program/project manager to determine the level of support activity needed and to establish agreements with other NASA Centers, Federal agencies, and/or contractors to accomplish these roles (Requirement 21021).

NOTE:

The managers listed in Table 1 are responsible for ensuring that the necessary work is assigned and carried out to the level indicated in the table (Requirement 30918). This table provides references to the documents where the requirements are established. References in bold are from this NPR.

Function	Associate Administrator for Safety and Mission Assurance	Enterprise Associate Administrator	Performing Center Director(s)	Certifying/ Performing Center SMA Director(s)	EAV Program/ Project Manager
Establish Agency SMA policies, procedures and guidelines, and standards (NPD 8700.1)	Lead				
Implement Agency SMA policies, procedures and guidelines, and standards. (NPD 8700.1 and Paragraph 1.4.1.a)		Lead (for Headquarters programs)	Lead (for Center programs/ projects)	Verify	Implement
Develop flight certification process for each EAV program/project (NPD 8700.2, paragraph 5.b.2, 5.d, and 5.f.2)	Support	Lead(Enterprise process)	Lead(Center process)	Support	Lead (Program/ Project process)
Ensure that all elements in Table 2 of paragraph 5.3 are addressed. (Paragraph 1.2.1, and Chapters 3, 4, and 5)	Verify	Participate	Participate	Support and provide SMA insight/ oversight and independent assessment	Lead
Conduct PRR or equivalent to evaluate the program/project-defined SMA processes (Chapter 2)	Lead	Participate	Participate	Support	Support
Provide ongoing surveillance of assurance process implementation (Paragraphs 3.1 and 3.2)	Verify		Support	Lead	Support

Provide program/ project SMA status to NASA SMA management (Paragraph 3.1.3)			Verify	Lead	Support
Establish and maintain mission assurance surveillance record over the life of the program/project (Paragraph 3.3)			Support	Lead	Support
Develop SMA program/project plan (NPR 7120.5)				Support	Lead
Conduct PAR or equivalent to verify implementation of SMA processes (Chapter 4)	Lead	Participate	Participate	Support	Support
Develop and implement SMA flight assessment process (Paragraph 5.1)	Participate	Participate	Support	Support	Lead
Execute/delegate EAV SMA flight assessment approval (Paragraphs 5.1 and 5.3)	Lead			Support	
Accept residual risk (Paragraph 1.2.2)	Support	Lead and coordinate with OSMA	Support	Support	Support
Process third-party indemnification requests (Paragraphs 1.3 and 5.2)	Participate	Lead and coordinate with OSMA, Chief Financial Officer, and General Counsel	Support	Support	Initiated by contractor via program/ project manager

Table 1 Terms:

Lead: Responsible for line item actions.
Suport: Assist the lead in performing and accomplishing.
Participants: Awareness of program/project status issues and status.
Verify: Provide oversight and insight to ensure accomplishment and to ensure that policies and procedures have been implemented.

Implement: Actionee for policy and procedures.

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